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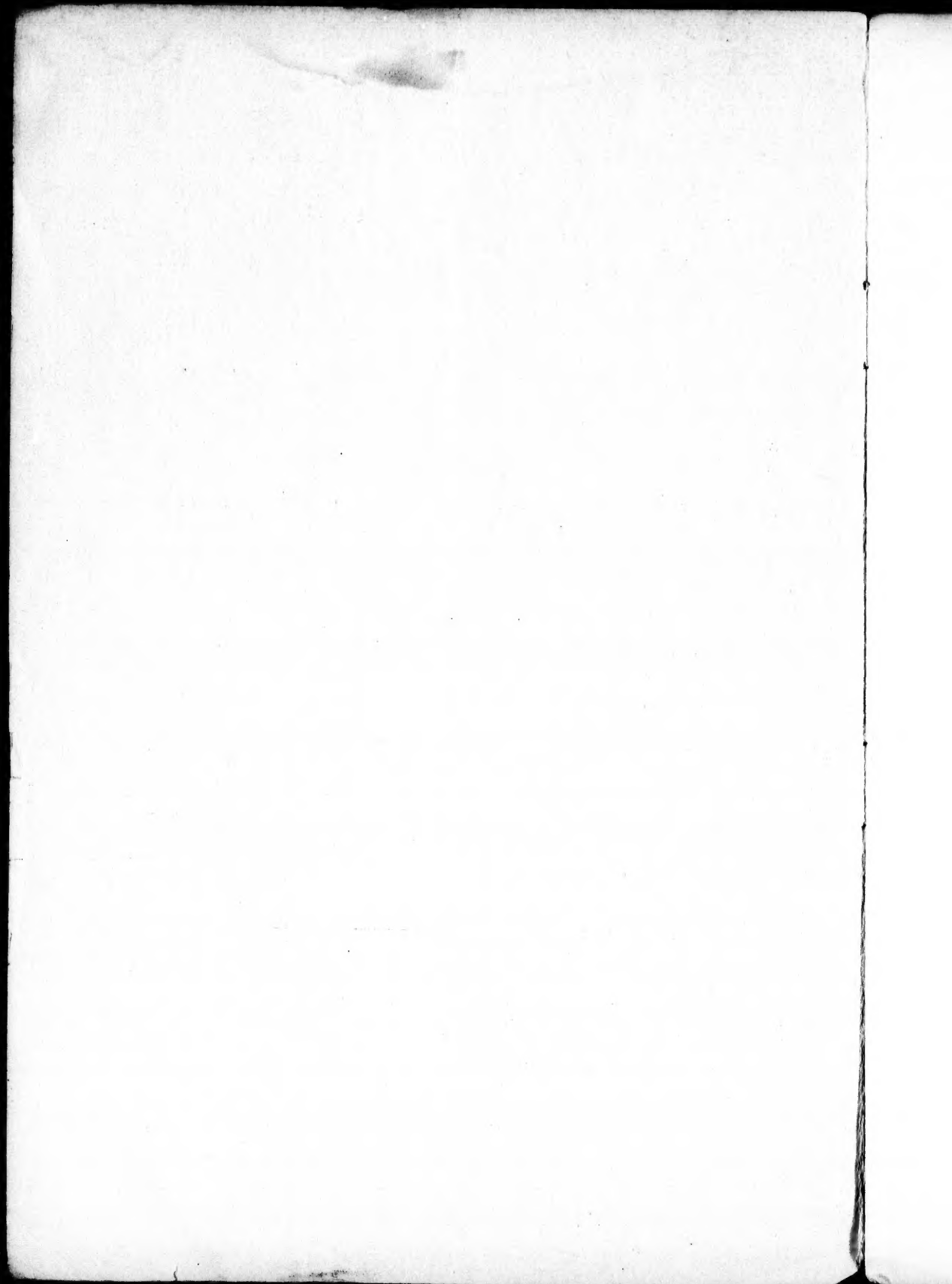
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**A CASE OF CEREBRO-SPINAL MENINGITIS ASSOCIATED
WITH THE MENINGOCOCCUS OF WEICHSELBAUM.**

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It is just a quarter of a century ago since the late Dr. Palmer Howard published the first record of observations on Cerebro-Spinal Fever in Montreal. This was in 1873, and during that period a small epidemic occurred, the cases breaking out in various parts of the city, as well as in the outlying districts. The published observations, however, are purely of a clinical character, and only one autopsy is recorded, that by Drs. Roddick and John Bell, in which it is noted that pus existed at the base of the brain and along the spinal cord. The majority of cases recorded at that time had affected boys from eight to ten years of age, some of the cases recovering, though, in the majority, a fatal issue supervened.

It is interesting to observe at this time, a time when bacteriology as a science had scarcely been created, the insistence which Dr. Howard laid upon the specific poison which he asserted must be associated with the malady. The early appearance of the purpuric condition, the general course of the disease, and its tendency to assume an epidemic character, all strongly favored the view that the disease was of a zymotic nature.

Since that time a few sporadic cases have been recorded, the observations for the most part being again of a purely clinical nature. Dr. Osler, in 1882, records in the Canada Medical and Surgical Journal

the first satisfactory pathological examination of any case in this city and since then a few isolated cases have been observed by Dr. Wyatt Johnston, though in none of these whatsoever was there any bacteriological examination made, other than to exclude the presence of tubercle bacilli.

The opportunity having been afforded us in the past few weeks of observing a similar case and obtaining satisfactory bacteriological examination, we take this occasion to bring it to the notice of the society, this being, to the best of our knowledge, the first instance in Canada where the meningococcus of Weichselbaum has been demonstrated at autopsy to be associated with cerebro-spinal fever, and the first time that acute purulent pericarditis has been noted as a complication.

The *history* of the case is of no little interest and affords a fairly typical example of the character of this rather uncommon disease. A young Canadian female aged 21 had been spending a few weeks in Boston immediately prior to her illness, her domicile being in a healthy and good locality. Quite a few cases, however, of cerebro-spinal fever have been observed in that city during the past few years, though the epidemic, it would appear, is now gradually dying out. During her visit to Boston, the weather had been very good, and she felt in excellent spirits. On the 28th of January, she returned to Montreal, arriving in the evening, seemingly in perfect health. Early the next morning she complained of chilly sensations, though to the touch her skin was hot and dry. Very shortly afterwards vomiting supervened and continued at intervals until the afternoon. Evidently the disease had a very acute onset, for when Dr. James Bell, in answer to a summons, saw her at half-past one in the afternoon, the facies seemed indicative of collapse, the face being drawn, thin and pale; she was now suffering from severe headache mainly occipital and in the nape of the neck. On examination, the temperature was 102°, the pulse small and rapid, but there was otherwise no evidence of disease except some tenderness over the lower portion of the abdomen. Upon the next day her condition was worse, the headache was very severe and she repeatedly cried out "Oh my head," referring the pain mainly to the region of the vertex and the occiput. There was, however, no more vomiting, and the abdomen was less tender, but the temperature remained over 100°. There was no improvement evident during the next 24 hours, and the patient showed distinct signs of delirium. Petechiæ were now noticed for the first time upon the abdomen, and there was general hyperæsthesia. When addressed she merely complained of the intense headache. On the same evening the patient was admitted to the Royal Victoria Hospital. While being dressed for

removal the rigidity of the neck was quite manifest, as also photophobia. All night long after admission the rigidity was most marked, and by the early morning the patient had become delirious. She assumed the dorsal position with her legs slightly flexed upon the abdomen. The pupils were equal and somewhat dilated, the tongue was dry and cracked, the temperature was 104.5° , the pulse 110, and the respirations 26. On this, the fourth day of the disease, the petechiæ upon the trunk were more marked, and new ones had appeared upon the arms. There was also a transient erythema upon the chest and for the first time herpes developed below the left labial angle; and what was of still greater interest, upon the left side of the nose and cheek. The rigidity of the body seemed to be more general, and the nurse in charge noticed from time to time clonic spasms in the upper extremities. By the afternoon delirium gave place to coma. It should be here mentioned that the diagnosis of epidemic cerebro-spinal meningitis having been made, the patient had been carefully isolated as a precautionary measure. In addition to the above symptoms, there was now noted increasing rapidity of the respirations, general hypertonus of the muscles, flexion of the arms at the elbows, and extension of the lower extremities, but there was no paralysis anywhere. Strabismus was not evident. The thoracic organs showed no special evidence of disease, and the abdomen was normal to palpation. The urine was turbid, contained a heavy sediment of urates, was acid in reaction, and had a specific gravity of 1023; there was a large amount of albumin as also numerous granular casts of large size. On the following day the temperature was still higher, 106.6° , and the coma became deeper. The pulse now for the first time, became distinctly irregular, but otherwise no special change could be observed. The usual colour changes in the petechiæ were manifest and no new ones had appeared. Examination of the blood on this, the fifth day of the disease, by Dr. Robins, the Resident Physician, showed the red cells to number 5,130,000, white cells 22,000, and the hæmoglobin 75 per cent. Cultures from the blood of the finger, which had been taken the day before on agar, serum and broth, all remained sterile. On the following day, in the afternoon, the patient died, progressive asthenia being the only noteworthy change. Lumbar puncture was made the same afternoon, but the cultures resulting were contaminated, and gave no evidence of the meningococcus.

The treatment adopted was of necessity purely symptomatic and supporting, in this way differing to some extent from that adopted by the late Palmer Howard, who recommended bromides, and iodides with digitalis, and considered strychnine as contraindicated.

Autopsy.—The autopsy was performed six hours after death with

the assistance of Dr. A. G. Nicholls, and the condition found was briefly as follows:

The body was poorly nourished, with rigidity marked in the jaw and lower extremities; the back was moderately livid. There were petechiæ upon the abdomen and arms, and a few likewise on the back; these varied in color according to their age, presenting all gradations from dark red to pale brown. Herpes was present upon the lower lip and left side of the nose. Both wrists were œdematous and slightly swollen, but the other joints appeared normal.

Head.—The calvarium was moderately thick with deep arterial grooves, the dura markedly congested, and the longitudinal sinus contained pale mixed clot and some dark fluid blood. The inner surface of the dura was reddened, but the dura itself showed no special thickening, nor was it adherent to the underlying pia-arachnoid. On exposing the arachnoid but very slight œdema was present, while a small quantity of greenish-yellow gelatinous lymph was seen in the subarachnoid space. This exudate was situated mainly on the convexity, along both sides of the longitudinal sinus and following the lines of the larger vessels. Over the temporal areas there was comparatively little, and nowhere was there any pus between the dura and the arachnoid. At the base of the brain there was likewise a moderate amount of pus, more especially behind the optic chiasm and the medulla, likewise between the cerebellum and the brain, and to a less extent in the central groove between the two hemispheres. The pia itself was distinctly adherent, quite œdematous and thickened. In the Sylvian fissures no evidence of tuberculosis or other abnormality could be ascertained. Upon opening the brain itself the lateral ventricles were found of normal size, and in the right were a few flakes of lymph, as also a few drops of fluid pus. The ependyma was slightly granular. The third and fourth ventricles were free from exudate. The white matter of the brain contained numerous punctiform extravasations of blood, and the gray matter was likewise congested, though to a less extent; the cerebellum was soft and friable, while the basal ganglia were congested and showed likewise minute hæmorrhages. The lateral sinuses contained dark fluid blood. The bones at the base of the skull showed nowhere any signs of disease.

Spinal Cord.—On removal of the brain a moderate amount of sero-purulent matter escaped from the vertebral canal. The cord itself was removed from behind, and after separation of the laminæ the dura was seen to be tensely expanded in various parts of its course irregularly. The vessels about it were congested. On slitting up the dura

the posterior surface of the pia-arachnoid was seen to contain numerous patches of lymph in the sub-arachnoid space; these existed as either fusiform collections of pus or were spread out in broad plaques over the posterior surface of the cord. There was distinct œdema of the pia, and in places it was markedly thickened. On section at various levels of the cord marked congestion was the main feature presented, but there seemed to be no evidences of punctate hæmorrhages.

With reference to the organs in general, the main conditions present were *acute purulent pericarditis*, œdema and partial collapse of the lungs, with acute bronchitis; obsolescent apical tuberculosis with left adhesive pleurisy, acute parenchymatous nephritis and catarrhal enteritis. The spleen was of normal size, and there was no further evidence in general of a septicæmia.

Bacteriological Examination.—Fresh coverslips, taken directly from the purulent exudate from the cerebral and spinal meninges, showed it to consist mainly of pus cells, fibrin, granular and colloid-looking masses. Some of the cells were of enormous size, three to four times that of an ordinary pus cell, containing large nuclei; some appeared to be vacuolated, and in a large number there were cell inclusions. Other cells, again, seemed much more ill defined, and their nuclei were irregular and fragmented. The leucocytes present were for the most part of the polynuclear variety. Specimens were stained by various methods, some with Löffler's blue, others with fuchsin, safranin and also by Gram's method. With Löffler's blue one saw semmel-shaped diplococci, resembling very much the gonococcus, except that the size varied very much and that they tended, further, frequently to form tetrads. The staining, too, was extremely irregular, some, and particularly the larger ones, taking up an almost black color, while others adjacent to them might be scarcely stained at all. While many of these were found within the cells, a very large number were constantly found free, our experience in this respect being quite at variance with that of Weichselbaum, Councilman and others; with this exception, however, the coverslip preparations corresponded in all respects to the descriptions given by these authors. On staining by Gram's method, the bacteria became decolorized.

Coverslips from the pericardial exudate showed likewise a pure culture of the same micro-organism, while others made from the larger bronchial tubes showed similar cocci mixed with numerous other forms. In the largest bronchi there were chiefly lanceolate diplococci and the meningococcus above described. Coverslips were likewise made from the spleen and liver pulp, from the heart blood and the bile, but in none of these instances did we obtain any bacteria.

secretions and demonstrated the presence of the micro-organism in stained coverglass preparations.

Cultures were made from the various tissues and organs of the body on different media, the most abundant growths being obtained on glycerinated agar. On this medium the *exudate* from the meninges gave an abundant growth after thirty hours, appearing at first as pearly gray dots, spreading out in plaques over the surface of the tube and gradually assuming a more grayish, opaque appearance. On staining with the various reagents above mentioned, the results were identical, and no definite chain formations were seen on this medium. On being transferred from the agar to broth, the growth was again abundant, appearing mainly in the sediment, the supernatant fluid remaining fairly clear. The diplococci were here for the most part large and arranged distinctly in chains, containing from four to eight cocci in each. Some of the chains, however, were made up of very much smaller organisms, resembling the ordinary pyogenic streptococci; that they were, however, of the same nature as the other diplococci was proven by their negative reaction to Gram's method. Cultures on glycerinated agar and broth from the *pericardial exudate* gave likewise pure cultures of the meningococcus. From the *heart blood*, the *liver*, the *spleen* and the *bile*, cultures taken on various media remained sterile. From the *lung* a mixed culture of staphylococci and lanceolate diplococci was obtained. While most observers have found agar the most suitable culture medium, it may be stated that the Boston bacteriologists have met with best results in employing blood serum; the differences are in all probability associated with the chemical reactions of the media. *Inoculations* of a three-days-old broth culture subcutaneously into a guinea-pig proved innocuous, as did also the intravenous injection into a rabbit of a 24-hour-old broth culture. It has been shown repeatedly that the life of these bacteria is extremely short, and transfers every second or fourth day are necessary to keep the germs alive. Hence a three days' growth might readily prove harmless to a guinea-pig, though the fact that recent growths were innocuous when introduced into the circulation is of no little interest.

Sections were made of the various organs and tissues of the body; those from the brain and meninges, including the exudate, showed mainly great dilatation of the blood vessels, with recent punctiform hæmorrhages and large collections of polynuclear leucocytes, with extreme fragmentation of the nuclei. Extensive areas of necrosis were likewise manifest in the nerve tissue. The micro-organisms were by no means easy to detect, the specimens stained with safranin giving the best results. In the spinal cord the same condition was evident,

but the more minute changes in the cellular elements are still under investigation. Sections from the other organs showed no features of special interest in connection with the case.

The presence of a pericardial exudate containing the meningococcus is quite evidently of extreme rarity, and the entire absence of fibrin on the serous coats is remarkable in view of the amount of pus present.

It will be seen, then, from the foregoing that the case recorded was quite evidently of the nature of an epidemic cerebro-spinal meningitis, while the organism associated with the lesions is undoubtedly the meningococcus described by Weichselbaum in 1886, and much more fully within the last twelve months by Dr. W. T. Councilman, of Boston. As is already well known, it has been generally accepted until quite recently that this malady is due to the diplococcus lanceolatus, while the organism described by Weichselbaum has been practically disregarded.

Observations made, however, since 1895, more especially by Jæger, of Stuttgart, and Councilman, Mallory, and Wright, of Boston, rendered it undoubted that in the epidemic form of this disease, not the pneumococcus, but the meningococcus of Weichselbaum is the chief etiological factor. The above-mentioned Boston pathologists had occasion to examine thirty-five cases post mortem, and the meningococcus was found in all but three cases. Certainly no such complete series of observations of any epidemic has hitherto been made commensurate with these, and the uniformity of their results in examining so extensive a material, places the nature of the disease beyond any doubt. It is true that in a number of cases the pneumococcus has been frequently found in pure culture, but so far as we are aware, it has never been demonstrated with a satisfactory uniformity. Flexner and Barker, of Baltimore, have recently published a most interesting and valuable article giving a detailed account of the conditions under which an epidemic of cerebro-spinal meningitis had occurred in a small mining town of Maryland. Sixty-eight patients were observed but unfortunately it was possible to obtain autopsies in only two instances. The pathological lesions in these cases are most minutely described, and the bacteriological examinations would seem to indicate that the pneumococcus was the chief organism present. Smears made from the exudate on the meninges showed a lance-shaped diplococcus which stained by Gram's method, but the cultures and inoculation test did not afford very satisfactory results. The authors, however, are of the opinion that the pneumococcus was undoubtedly present, although the trying circumstances under which the investigations were made rendered it impossible to obtain eminently satisfactory results.